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Comparison of FeO and TiO_2 abundance with 6-meter wavelength radar mapping of the Moon

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Long-wavelength radio waves can penetrate the lunar surface and provide novel insights to subsurface structures invisible at high-frequency radar and optical wavelengths. Observing beneath the lunar regolith provides a means to view the history of lunar geologic stratigraphy, transition zones and buried features. This involves analyzing radar observations at a range of wavelengths in conjunction with other remote data sets to investigate the physical properties of the lunar regolith. Comparison in particular with surface metallic content, such as iron oxide and titanium dioxide, can help to pinpoint the features responsible for radar loss. Using recent range-Doppler images of the Moon made with radio waves of 6-meter wavelength, we present a comparison of low-frequency radar mapping of the Moon's nearside with lunar mapping of FeO abundance from Clementine UltraViolet/Visible (UVVIS) data and TiO$_2$ abundance from LROC WAC. The low-frequency radar mapping was taken with Jicamarca Radio Observatory 49.92 MHz radar. The images have approximately 10 km resolution in range and 20 km resolution in Doppler, allowing many large scale features, including maria, terrae, and impact craters to be identified. Radar mapping is done with polarizations opposite to and matched to the expected specular return from the surface. Strong return is observed from relatively new impact craters with large breccia and shallow regolith. Terrae regions with less lossy surface material also appear brighter. A large region in the Mare Orientale impact basin has overall higher than mean radar backscatter, indicating a higher than average amount of newly formed large breccia in this region. The mapping also reveals areas of low backscatter return, indicating radar signal of basaltic composition, from regions with an optical appearance of Terrae composition. These are most notable at an old impact basin in this Schiller-Schickard region, and also a large region of low radar return connecting the Mare Frigoris and Mare Imbrium. Regions of low radar return in the 6-meter lunar radar map are found to be correlated with high FeO abundance obtained from Clementine data. We are investigating the possible scenarios which could cause this effect.